



west virginia department of environmental protection

Division of Air Quality
601 57th Street, SE
Charleston, WV 25304
Phone: (304) 926-0475

Harold D. Ward, Cabinet Secretary
dep.wv.gov

ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.: R13-3509
Plant ID No.: 073-00040
Applicant: West Virginia Methanol, Inc.
Facility Name: Pleasants County Methanol Plant
Location: Waverly, Pleasants County
SIC/NAICS Code: 2869/325199
Application Type: Construction
Received Date(s): November 23, 2020, March 15, 2021 (Resubmitted)
Engineer Assigned: Joe Kessler
Fee Amount: \$2,000
Date Received: November 23, 2020
Complete Date: March 24, 2021
Due Date: June 22, 2021
Applicant's Ad Date: November 25, 2020
Newspaper: *St. Marys Oracle*
UTM's: 469.49 km Easting • 4,354.38 km Northing • Zone 17
Latitude/Longitude: 39.33832/-81.353048
Description: Proposed natural gas-to-methanol plant consisting of three (3) identical ~362 tons/day production units. Facility would also include on-site power generation utilizing seven (7) 5,500 horsepower natural gas-fired engines.

DESCRIPTION OF PROCESS

West Virginia Methanol, Inc. (WVM) is proposing to construct an approximately 993 tons/day natural gas-to-methanol plant at the former site of Cabot Corporation's Ohio River Carbon Black Plant located along WV State Route 2 near Waverly, Pleasants County, WV. The proposed facility would consist of three (3) identical MeOH-TO-GO™ small-scale modular methanol plants (while the chemical formula for methanol is CH₃OH, it is often abbreviated as MeOH), each with a maximum production capacity of 362 tons/day (~109,600 gallons/day). If operated at a theoretical maximum of 8,760 hours per year, the facility would have a maximum nominal annual production capacity of approximately 396,390 tons of methanol (~120,000,000 gallons/year). To produce the methanol, the facility would use a maximum of approximately 36 mmft³/day of pipeline natural gas (based on a heat input requirement of 1,500 mmBtu/hr and a nominal natural gas heat content of 1,000 Btu/scf).

Promoting a healthy environment.

MeOH-To-Go™ Production Units

Each MeOH-To-Go™ unit is comprised of the following equipment/processes:

- Pre-Reformer section;
- One Steam Methane Reformer (SMR) consisting of a Haldor Topsoe Convection Reformer (HTCR) system, including a waste heat recovery boiler with a supplemental Duct Burner. The HTCR is equipped with selective catalytic reduction (SCR) for control of nitrogen oxides (NO_x) and an oxidation catalyst for Carbon Monoxide (CO) emissions control;
- One methanol synthesis section and off-gas recovery to the HTCR fuel system; and
- One methanol distillation system and off-gas recovery system to the HTCR fuel system.

Pre-Reformer

Each methanol unit has a Pre-Reformer section (S1A, S1B, S1C) that includes a desulfurization system, feed preheaters, a hydrogenator, and a pre-reformer vessel. The desulfurization system removes sulfur-containing compounds (mostly Mercaptan to near undetectable levels) from the pipeline-quality natural gas (PNG) feeding the pre-reformer. The Pre-Reformer section converts the higher hydrocarbons in the PNG to methane, hydrogen, carbon monoxide, and carbon dioxide in preparation for SMR feed. The Pre-Reformer does not generate emissions during normal steady-state operations. However, during certain defined startup and shutdown scenarios as described below, gases from the Pre-Reformer are sent to unit's specific flare (C2A, C2B, C2C) for control.

Steam Methane Reformer

Each methanol unit has a HTCR Steam Methane Reformer (S2A, S2B, S2C) that utilizes convection heat transfer minimizing surplus steam production and therefore also minimizing additional fuel firing. The HTCR produces syngas from PNG and self-generated steam. The syngas production requires heat which, during steady-state operations, is supplied primarily by the combustion of hydrogen-rich process purge gases and supplemented up to 10% with PNG "trim gas" to control temperature. PNG is also used as needed during startup and unit trips when the purge gas is not available. During transition from purge gas interruptions, PNG is slowly replaced by purge gases as they become available until reaching steady-state operation. The HTCR consists of:

- A single "HTCR Heater" in a furnace where heat for the reforming reaction is generated. The maximum design heat input (MDHI) for this HTCR Heater, when combusting only purge gas, is calculated to be 206.57 mmBtu/hr based on a purge gas flow of 447,123 scf/hr and a high-heating value (HHV) of 462 Btu/scf. When combusting only PNG, the MDHI of the HTCR Heater is calculated to be 212.25 mmBtu/hr based on a maximum PNG combustion rate of 195,800 scf/hr with an HHV of 1,084 Btu/scf. All MDHI numbers given here and below for the SMR Heaters are based on process design flow rates increased by a safety margin of 10%;

- A multi-tube reforming reactor where syngas is produced by the reaction of pre-reformed natural gas and steam over a catalyst; and
- A flue gas waste heat boiler section with supplemental firing (Duct Burner) where heat from the reforming section is recovered and fuel is combusted to supply additional heat for the production of steam. The MDHI for the Duct Burner when combusting only purge gas is calculated to be 25.56 mmBtu/hr based on a purge gas flow of 55,318 scf/hr and a HHV of 462 Btu/scf. When combusting only PNG, the MDHI of the Duct Burner is calculated to be 63.80 mmBtu/hr based on a maximum PNG combustion rate of 58,850 scf/hr with an HHV of 1,084 Btu/scf.

As stated above, during normal steady-state operations, the SMR burners are fueled primarily by the combustion of hydrogen-rich process purge gases and supplemented up to 10% with PNG “trim gas” to control temperature. Combustion emissions from the HTCR burner and Duct Burners would be combined and exhausted to an SCR unit for control of NO_x emissions and an oxidation catalyst for control of CO emissions (in aggregate labeled as C1A, C1B, C1C). WVM is also proposing the use of good combustion practices to minimize emissions. "Good Combustion Practices" shall mean activities such as maintaining operating logs and record-keeping, conducting training, ensuring maintenance knowledge, performing routine and preventive maintenance, conducting burner and control adjustments, use of pipeline quality natural gas, etc.

The HTCR reactor, which operates under high pressure, is not vented to atmosphere under normal operating conditions. Therefore, during normal steady-state operations, the only emissions from the unit are generated from the combustion of fuel gas. However, during certain defined startup and shutdown scenarios as described below, gases from the SMR are sent to unit’s specific flare (C2A, C2B, C2C) for mitigation.

Methanol Synthesis Section

The Methanol Synthesis Section (S3A, S3B, S3C) consists of a series of heat exchangers, knock-out drums and catalytic reactors that convert the syngas to a crude methanol liquid stream comprised of approximately 80 percent methanol and 20 percent water. The methanol synthesis system includes off-gas recovery from the knock-out drums and a hydrogen-rich, sulfur free off gas stream which are both directed to the HTCR Heaters and Duct Burners, where these purge gases serve as the primary fuel. The Methanol Synthesis Section, which normally operates under high pressure, is not vented to atmosphere under normal operating conditions. However, during certain defined startup and shutdown scenarios as described below, gases from the Methanol Synthesis Section are sent to unit’s specific flare (C2A, C2B, C2C) for mitigation.

Methanol Distillation System

The Methanol Distillation System (S4A, S4B, S4C) consists of a series of distillation and refining columns that purify the crude methanol and purify the byproduct water so it can be recycled in the process. The Methanol Distillation System is not vented to atmosphere. Any off-gases from methanol distillation are recovered and used in the fuel system for the HTCR Heaters and Duct

Burners. However, during certain defined startup and shutdown scenarios as described below, gases from the Methanol Distillation System are sent to unit's specific flare (C2A, C2B, C2C) for mitigation.

Flares

Each Methanol Unit is equipped with an elevated (≥ 175 feet) flare (S5A, S5B, S5C) located adjacent to the HTCR stack. The flare is designed as a dual High Pressure (HP)/Low Pressure (LP) unit to handle both duties during startup/shutdown/unit trips (HP), and to handle small equipment leaks as necessary (LP). The flare utilizes an aggregate of six (6) 0.045 mmBtu/hr pilot lights. During normal operations, no vapors are sent to the HP flare, only during startup/shutdown and unit trips does the HP flare operate (beyond just the pilot lights). However, during startup/shutdown of the facility and unit trips, process/purge gas is sent to the flare for combustion. The LP flare is utilized to combust small amounts of intermittent vapors sent to the flare when the Pressure Safety Valves (PSVs) trip or certain equipment leaks occur between mandated LDAR repairs.

Methanol Storage and Loadout

In addition to the production units, the facility would include eight (8) 375,000 gallon methanol product storage tanks (S6T1 - S6T9). The proposed tanks would be 40-foot diameter by 40-foot high. They would be designed to operate under pressure using a nitrogen blanket to prevent any working/breathing losses. Any over-pressure occurrences would vent back to the process.

The facility would be designed to include loadout capabilities to tanker trucks, rail cars, and barges. The truck and railcar loadouts would each use two (2) dedicated 400 gallon/minute methanol loading racks. The barge loadout would use two (2) 1,500 gallons/minute barge loading pumps. All loadouts would utilize vapor balancing and Lowest Achievable Emission Rate (LAER)-level hose dry disconnect technology to mitigate any emissions of methanol during loadout.

Power Generation Unit

The proposed facility would include on-site power generation unit (SG1 - SG7) to provide power for the methanol production operations only (power would not be connected to the utility power grid). This unit would consist of seven (7) 4-Stroke Lean Burn (4SLB), 5,500 horsepower (hp), Caterpillar Model CG260-16 natural gas-fired Reciprocating Internal Combustion Engines (RICE). Each engine would have a nominal capacity to generate 4 mW_e, with a maximum of six (6) engines running at any one time, for a nominal plant-wide generating capacity of 24 mW_e. Each engine's exhaust will be equipped with a SCR system to control NO_x emissions and an oxidation catalyst to control emissions of VOC, CO, and various Hazard Air Pollutants (HAPs).

Startup/Shutdown/Unit Trip Scenarios

During normal steady-state operations, no synthesis gas or purge gas is sent to the flare or vented to atmosphere. All off-gases are either recycled back into the process or sent to the fuel gas header for combustion in the SMR Heaters. However, WVM has identified four (4) scenarios where these gases must be purged and are sent to the flare for destruction: (1) Cold Startup, (2) Methanol Synthesis Trip ("Syn Loop Trip"), (3) Hot Startup from HTCR Trip ("Reformer Trip and Restart"),

and a (4) Total Unit Trip (“Shutdown”). Additionally, during events 1-3 combustion exhaust continues to be sent up the SMR Heater stacks (either the HTCR Heater, Duct Burner, or both) but the fuel is transitioned from fuel gas to PNG (and then back again).

Each of these scenarios are given a detailed summary in the permit application (on pages 8 and 9). For each scenario, Haldor Topsoe has provided WVM with worst-case hourly and per-event emissions. The maximum duration of each event and the maximum number of events per year (per unit) are given in the following table:

Table 1: Per-Unit Startup/Shutdown/Unit Trip Scenarios

Scenario	Duration (Hours)	Events/Unit/Yr	Total Hours/Year
Cold Startup	32.5	4	130.0
Syn Loop Trip	18.9	2	37.8
Reformer Trip and Restart	15.3	2	30.6
Shutdown	4.0	4	16.0

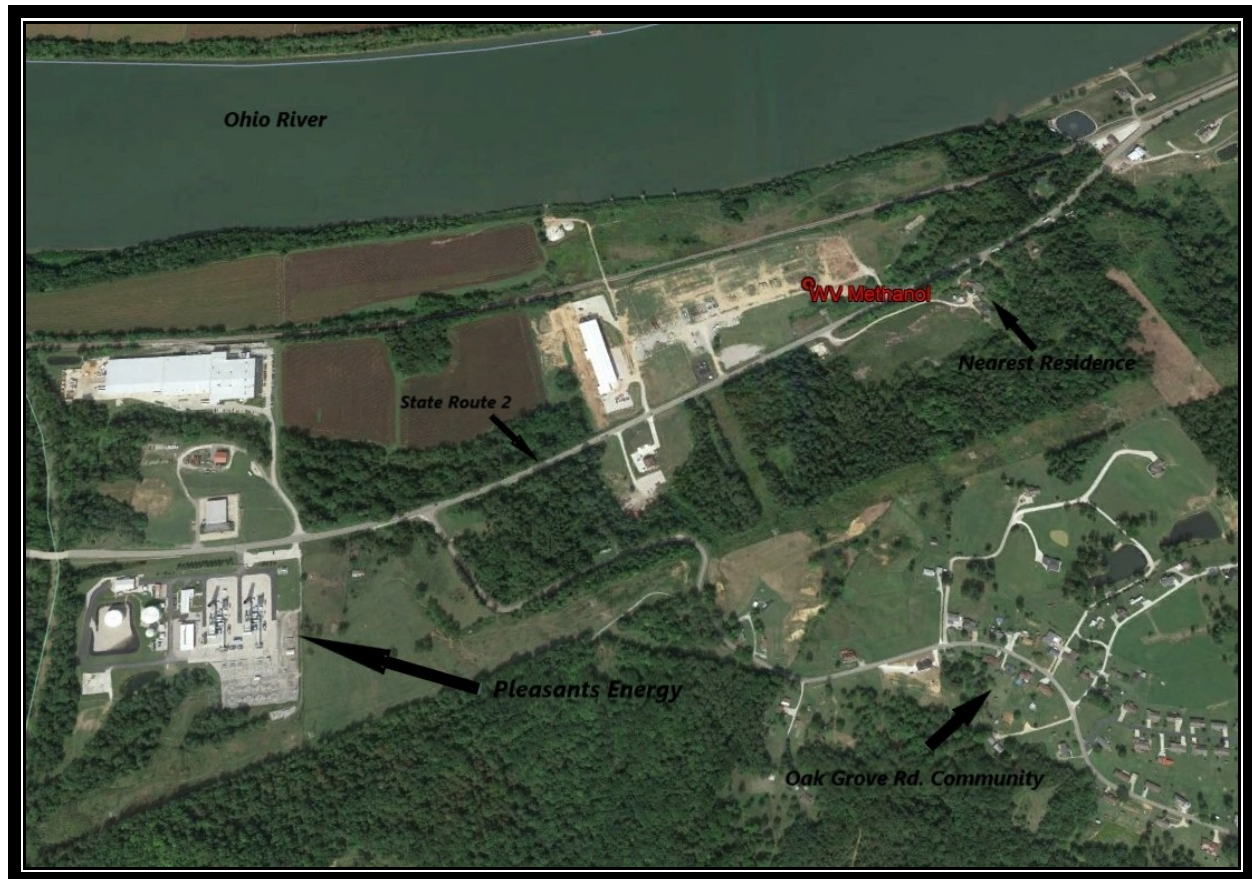
SITE INSPECTION

The writer did not conduct a new on-site inspection of the proposed location of the Pleasants County Methanol Plant. However, the proposed site is the well-known location of Cabot Corporation’s former Ohio River Plant (facility operated from 1967 until 2008), a site which the writer did visit several times while the facility was in operation. Observations from previous on-site inspections and a virtual investigation of the site are as follows:

- The proposed site lies just past the Pleasants County line between WV State Route (SR) 2 to the south and the Ohio River to the north. East and west of the facility along the river lie other commercial and industry facilities and open construction storage areas. The Pleasants Energy natural gas-fired power plant is located approximately 0.6 miles to the southwest; and First Energy’s coal-fired Pleasant County is located approximately 3.74 miles to the northeast. While the area as a whole would not be classified as either heavily industrial or heavily residential, generally the Ohio River valley north of Waverly could be reasonably classified as industrial while the hills inland could be reasonably classified as rural/residential;
- It appears the nearest occupied residence is approximately 0.25 miles from the facility across Route 2. The nearest local community lies out of the river valley in the hills directly south of the proposed site along Oak Grove Road, at an approximate distance of 0.40 miles. The town of Waverly lies approximately 1.30 miles to the west of the site and Parkersburg lies approximately 10 miles to the south-southwest; and
- During the last time the writer drove past the site in 2019, and based on images taken from Google Earth™, the site is currently used as an area of construction equipment storage.

Directions: [Latitude: 39.33832, Longitude: -81.353048] The proposed site lies along and just left of WV SR2 approximately 1.5 miles past the junction of WV SR2 and the Waverly Street.

The following is labeled satellite imagery of the proposed site of the proposed Pleasants County Methanol Plant taken from Google Earth™:



AIR EMISSIONS AND CALCULATION METHODOLOGIES

WVM included in Attachment N of the permit application air emissions calculations for the proposed Pleasants County Methanol Plant. The following will summarize the calculation methodologies used by WVM to calculate the potential-to-emit (PTE) of the proposed facility.

Steady-State SMR Combustion Exhaust Emissions

Potential emissions during steady-state (non startup/shutdown/unit trip) operations from each of the SMRs Heaters (including both the HTCR Heater and the Duct Burner) are based on emission factors provided by the unit vendor and from AP-42, Section 1.4 - “Natural Gas Combustion” (AP-42 is a database of emission factors maintained by USEPA). The SMR heaters will be fired during steady-state operations primarily by the combustion of hydrogen-rich process purge gases and supplemented up to 10% with PNG “trim gas” to control temperature. The combustion exhaust will be ducted to an SCR unit for control of NO_x emissions and an oxidation catalyst for control of CO

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emissions (C1A, C1B, C1C). Potential HAP emissions during steady-state operations were based primarily on the use of a maximum of 10% PNG trim gas, as the purge gas has no detectable HAP components other than methanol at a maximum of 1% (by volume) of the purge gas, which is then almost completely combusted in the heaters (to be conservative, WVM estimated a DRE of 99.99% in the heaters).

During steady-state operations, the SCR and oxidation catalyst will be fully functional and operating at their peak efficiencies. The maximum flow rate during steady-state operations was provided by the vendor at 91,290 Nm³/hr (dry). As with the MDHI numbers given, this flow rate was based on the process design rate increased by 10% to account for a safety factor. To be conservative, the maximum annual emissions of each of the SMRs was based on operating in steady-state for 8,760 hours/year (although the permittee is also counting a number of hours that each unit will be operating in a non-steady-state scenario). The steady-state emissions from the SMR heaters are detailed on page 136 and 137 of the permit application and given in the following table:

Table 2: Per-SMR (HTCR/Duct Burner Combination) Steady-State PTE

Pollutant	Emission Factor ⁽¹⁾	DRE (%)	Source	Hourly (lb/hr)	Annual (ton/yr)
CO	9.16 mg/Nm ³ (controlled)	44.8	Vendor	1.84	8.08
NO _x	15.05 mg/Nm ³ (controlled)	90.0	Vendor	3.03	13.27
PM _{2.5} /PM ₁₀ /PM ⁽¹⁾	5.00 mg/Nm ³	n/a	Vendor	3.02	13.22
SO ₂	6.00 x 10 ⁻⁴ lb/mmBtu ⁽²⁾	n/a	AP-42, Table 1.4-2	0.14	0.61
VOCs	5.00 mg/Nm ³	0 ⁽³⁾	Vendor	1.01	4.41
Total HAPs	Various ⁽⁴⁾	* ⁽⁴⁾	n/a	0.12	0.50

(1) All particulate matter is assumed 2.5 microns or less. Includes condensables.

(2) Rounded up from 6.00 x 10⁻⁴ lb/mmBtu.

(3) While some reduction in VOCs from the oxidation catalyst is expected, the applicant has chosen to use no reduction to be conservative.

(4) Total HAP emissions based on AP-42, Section 1.4 for use of the PNG trim gas and on a 1% methanol content (by volume) of the purge gas (and a DRE of 99.99% of the methanol in the SMR).

Plant-wide Startup/Shutdown/Trip Emissions

WVM has identified four (4) known scenarios where potential emissions may occur during startup, shutdown, or unit trips: (1) Cold Start, (2) Syn Loop Trip, (3) Reformer Trip and Restart, and (4) Shutdown. During each of these scenarios, specific gas streams are purged and sent to the applicable HP section of the Flare (C2A, C2B, C2C) for destruction. Additionally, in events 1-3, either the HTCR Heater or the SMR Duct Burner continues to operate but transitions to PNG instead of fuel gas and then back again. Worst case hourly emissions and total emissions per specific event were provided by the methanol unit vendor (Haldor Topsoe) and the annual emissions from these events were based on a maximum of four (4) Cold Starts, four (4) plant Shutdowns, two (2) Syn Loop Trips, and two (2) Reformer Trip and Restarts (see Table 1). The emissions from these events are detailed on pages 139 through 155 of the permit application. The calculations assume a standard minimum flare DRE of 98% for VOCs and 98% for any CO in the purged gas.

It is important to note that there are two sources of CO being emitted at each HP flare during the trip events: unburnt constituent CO in the waste gas and CO oxidized by the combustion of carbon in the waste gas. The constituent CO in the waste gas is combusted and converted to CO₂ at a minimum DRE of 98% (therefore, 2% of the CO in the waste gases are estimated to be emitted at the flare). The CO created from oxidation of some of the carbon species in the waste gas does not have any DRE applied to it and was calculated using an emission factor taken from AP-42, Section 13.5 as noted below. The Haldor Topsoe simulation software combined both of these CO sources and that is the basis for the CO PTE of each of the Startup/Shutdown/Trip Emissions scenarios.

Emissions from the SMR Heaters, when combusting natural gas during events 1-3, were based on emission factors taken from AP-42, Section 1.4 - "Natural Gas Combustion." Worst case hourly emissions from the SMR heaters during these events were based on the MDHI of the units and the annual emissions contributed to the facility PTE were based on the maximum annual per-event hours as given under Table 1 above. An oxidation catalyst DRE of 85% was used on CO emissions when the SMR heaters are combusting PNG during events 1-3.

The per-unit total annual and worst-case hourly (based on the highest per-hour emission rates of any Startup/Shutdown/Trip scenario) is given in the following table. Detailed per-scenario emission information is included on pages 139 through 155 in Attachment N of the permit application.

Table 3: Per-Methanol Unit Startup/Shutdown/Unit Trip Emissions⁽¹⁾⁽²⁾

Pollutant	Flaring		HTCR/Duct Burner	
	lb/hr	ton/yr	lb/hr	ton/yr
CO	523.01	9.12	2.71	0.15
NO _x	38.82	1.19	1.91	0.15
PM _{2.5}	11.02	0.24	1.02	0.06
PM ₁₀	14.70	0.31	1.37	0.07
PM	14.70	0.31	1.37	0.07
SO ₂	0.25	0.001	0.17	0.001
VOCs	9.99	0.16	2.88	0.16
Total HAPs	10.02	0.11	0.33	0.02

- (1) Hourly emissions based on different scenarios depending on the worst short-term emissions profile of that scenario. Worst-case hourly emissions from any scenario not necessarily representative of the emissions profile for the entire length of the event.
- (2) This table is inclusive of flare combustion exhaust emissions as discussed below.

Flare Combustion Exhaust Emissions

Each unit Flare (E2A, E2B, E2C) has the potential to combust waste gases from two different sources: (1) purged system gases during one of the startup/shutdown/unit trip scenarios as discussed above, or (2) very low pressure vapors from small PSV trips/intermittent equipment leaks that are connected to the flare. As noted above, each Flare has two tips, one HP section and an LP section.

The HP section handles the purge gases during startup/shutdown/unit trips and the LP section handles vapors from the PSV trips/intermittent equipment leaks. Natural gas is also combusted in the each Flare section's pilot lights (with an aggregate heat input of 0.27 mmBtu/hr).

Emissions generated from the combustion of waste gases in the HP section were based on emission factors from AP-42, Section 13.5 - "Industrial Flares." Emissions generated from the combustion of natural gas in the pilot lights were based on emission factor from AP-42, Section 13.5 (CO, NO_x, PM) and AP-42, Section 1.4 (SO₂, VOCs). As noted above, the purge gas combustion exhaust missions are included in the spreadsheets given on pages 139 through 155 in Attachment N of the permit application. The small emissions associated with the pilot lights are given in the LP Section of the spreadsheets on page 156 of the permit application.

Natural Gas-Fired Engines

Potential emissions from each of the seven (7) 4SLB, 5,500 hp, 4,102 kW_m, Caterpillar Model CG260-16 natural gas-fired engines were based on post-control emission factors provided by the catalyst manufacturer and as given in AP-42, Section 3.2 (7/00). Each engine's exhaust will be equipped with an SCR system to control NO_x emissions and an oxidation catalyst to control emissions of VOC, CO, and (some) HAPs. The maximum hourly emissions were based on the rated mechanical power output (4,102 kW_m) and the HHV MDHI (35.51 mmBtu/hr @ 8,656 Btu/kW-h) of the engines. Annual emissions of each were based on 8,760 hours of operation per year. While the permittee has stated that only a maximum of six (6) engines would run at one time, the aggregate PTE from the engines are based on all seven (7) running 8,760 hours/year. The engines emissions are detailed on pages 158 and 159 of the permit application. The following table details the PTE of each engine:

Table 4: Per-Engine PTE

Pollutant	Emission Factor⁽¹⁾	DRE (%)	Source	Hourly (lb/hr)	Annual (ton/yr)
CO	0.1392 g/kW-hr (controlled)	91.9	Vendor	1.26	5.51
NO _x	0.1763 g/kW-hr (controlled)	86.0	Vendor	1.59	6.98
PM _{2.5} /PM ₁₀ /PM ⁽²⁾	0.0121 g/kW-hr	n/a	Vendor	0.11	0.48
SO ₂	6.00 x 10 ⁻⁴ lb/mmBtu	n/a	AP-42, Table 3.2-2 ⁽³⁾	0.02	0.09
VOCs	0.1059 g/kW-hr (controlled)	50.0	Vendor	0.96	4.20
Formaldehyde	0.0326 g/kW-hr (controlled)	91.0	Vendor	0.30	1.29
Total HAPs	0.0567 g/kW-hr (controlled)	Various ⁽⁴⁾	Vendor, AP-42, Table 3.2-2	0.51	2.25

- (1) Where applicable, based on uncontrolled emission factors provided by vendor (pp. 120 of the permit application) multiplied by the DRE listed in this table. DRE's used in this table were lower (based on engineering estimate) than those listed by the vendor to build in a conservative bias (higher emissions) in the engine's PTE.
- (2) All particulate matter is assumed 2.5 microns or less. Includes condensables.
- (3) Rounded up from 5.88 x 10⁻⁴ lb/mmBtu.
- (4) DRE's were factored into emission factors for certain HAPs as shown on page 159 of the permit application and were based on information supplied by the catalyst vendor (pp 133, with safety margin applied).

Fugitives

Equipment Leaks

WVM based their uncontrolled VOC/HAP and CO (from components servicing syngas) fugitive equipment leak calculations on emission factors taken from the document EPA-453/R-95-017 - "Protocol for Equipment Leak Emission Estimates" Table 2-5. No control efficiencies, as based on a Leak Detection and Repair (LDAR) protocol, were applied. However, the emission factors used assume an LDAR screening threshold of <10,000 ppm_v (which is appropriate based on the applicability of 40 CFR 60, Subpart VVa which has a maximum screening threshold of 10,000 ppm_v). VOC/HAP/CO by-weight percentages were based on the gas or liquids being serviced by the components as provided by Haldor Topsoe. Controlled emissions from Pressure Safety Valves (PSVs) that are captured and sent to a Flare (E2A, E2B, E2C) are based on a DRE of 98%. Component counts were based on an engineering estimate provided by Modular Plant Solutions. The detailed table of equipment leak calculations is on pages 160 and 161 of the permit application.

Vehicle Activity

WVM included in their application (page 162) an estimate of fugitive emissions created by truck traffic (miscellaneous trucking) at the facility. As all the roadways around the building shall be paved, WVM used the equation given in Section 13.2.1 of AP-42 and appropriate variables to estimate potential emissions.

Emissions Summary

Based on the above estimation methodology as submitted in Attachment N of the permit application, the facility-wide annual PTE of the proposed Pleasants County Methanol Plant is given in the following table and in more detail in Attachment A.

Table 5: Facility-Wide Annual PTE

Pollutant	TPY
CO	91.76
NO _x	92.98
PM _{2.5(1)}	17.66
PM ₁₀₍₁₎	18.13
PM ⁽¹⁾	19.10
SO ₂	2.45
VOC	49.45
Total HAPs	23.46

(1) Including condensables.

REGULATORY APPLICABILITY

The proposed Pleasants County Methanol Plant is subject to the following substantive state and federal air quality rules and regulations: 45CSR2, 45CSR6, 45CSR7, 45CSR10, 45CSR13, and 40 CFR 60 Subparts Kb, VVa, NNN, and RRR. Each applicable rule and WVM's compliance therewith will be discussed in detail below.

45CSR2: To Prevent and Control Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers

45CSR2 “establishes emission limitations for smoke and particulate matter which are discharged from fuel burning units.” A fuel burning unit is defined under 45CSR2 as any “*furnace, boiler apparatus, device, mechanism, stack or structure used in the process of burning fuel or other combustible material for the primary purpose of producing heat or power by indirect heat transfer.*” Additionally, the definition of “indirect heat exchanger” specifically excludes process heaters, which are defined as “*a device that is primarily used to heat a material to initiate or promote a chemical reaction in which the material participates as a reactant or catalyst.*” Based on these definitions, 45CSR2 will not apply to the HTCR Heaters as their *primary* function is to provide heat for the reforming reaction in the SMR furnace. While the heated exhaust is also routed through heat exchangers to produce steam, the primary purpose of the units is clearly to promote a chemical reaction. However, the 25.56/63.80 mmBtu/hr supplemental Duct Burners’ primary purpose is to provide additional heat in the exhaust to produce steam. Therefore the Duct Burners are subject to 45CSR2. Each substantive 45CSR2 requirement is discussed below.

45CSR2 Opacity Standard - Section 3.1

Pursuant to 45CSR2, Section 3.1, the Duct Burners are subject to an opacity limit of 10%. Proper maintenance and operation of the units (and the use of natural gas/purge gas as fuel) should keep the opacity of the units well below 10% during normal operations.

45CSR2 Weight Emission Standard - Section 4.1(b)

The facility-wide allowable particulate matter (PM) emission rate for the SMRs noted above, identified as Type “b” fuel burning units, per 45CSR2, Section 4.1(b), is the product of 0.09 and the total aggregate design heat input of all the applicable units in million Btu per hour.

When combusting purge gas during steady-state operations, based on an aggregate MDHI of the three (3) 25.56 mmBtu/hr Duct Burners, the total facility-wide MDHI of applicable units is 76.68 mmBtu/hr. Using the above equation, the 45CSR2 aggregate PM emission limit of the SMRs will be 6.90 lb/hr. This limit represents filterable PM only and does not include condensable PM. The exemption of condensable PM is located within the 45CSR2 Appendix - which establishes compliance test procedures - by not requiring measurement of the condensable PM. The maximum aggregate potential hourly PM emissions during normal operations from the all the Duct Burners alone is not given (as the exhaust from the Duct Burners and the HTCR Heaters are combined), but the same total hourly emissions from all SMR Heaters *including* the exempt HTCR Heaters is

estimated to be 3.02 lb/hr (*including* condensables, which is not required to show 45CSR2 compliance). This extremely conservative aggregate emission rate is still below the 45CSR2 limit.

When combusting PNG during startup and unit trips, based on an aggregate MDHI of the three (3) 63.80 mmBtu/hr Duct Burners, the total facility-wide MDHI of applicable units is 191.40 mmBtu/hr. Using the above equation, the 45CSR2 aggregate PM emission limit for the Duct Burners is 17.23 lb/hr. The maximum aggregate potential hourly PM emissions during any scenario is during the “Syn Loop Trip” when, from the all the SMRs (including the exempt HTCR Heaters), the maximum aggregate particulate matter emissions is estimated to be 4.11 lb/hr (*including* condensables, which is not required to show 45CSR2 compliance). This extremely conservative emission rate is again still below the 45CSR2 limit.

45CSR2 Testing, Monitoring, Record-keeping, & Reporting (TMR&R) - Section 8

Section 8 of 45CSR2 requires testing for initial compliance with the limits under Section 3 and 4, monitoring for continued compliance, and record-keeping of that compliance. The TMR&R requirements are clarified under 45CSR2A and discussed below.

45CSR2A Applicability - Section 3

Pursuant to 45CSR2, Section 3.1(b), the owner or operator of a “*fuel burning unit(s) which combusts only natural gas shall be exempt from sections 5 and 6.*” Therefore, there is no substantive performance testing or monitoring requirements under 45CSR2 for the proposed Duct Burners. Pursuant to DAQ precedent, the use of syngas/purge gas produced from natural gas would still qualify for this exemption.

45CSR2A Record-keeping and Reporting Requirements - Section 7

Section 7 sets out the record-keeping requirements that WVM will have to meet under 45CSR2A for the Duct Burners. For units that combust only PNG (and as noted above, syngas/purge gas), the record-keeping requirements are limited to the date and time of start-up and shutdown, and the quantity of fuel consumed on a monthly basis.

45CSR6: To Prevent and Control Particulate Air Pollution from Combustion of Refuse

WVM has proposed the use of flaring - one flare for each methanol production unit - for control of various waste gas streams (see above). Each flare meets the definition of an “incinerator” under 45CSR6 and is, therefore, subject to the requirements therein. The substantive requirements applicable to the enclosed flare are discussed below.

45CSR6 Emission Standards for Incinerators - Section 4.1

Section 4.1 limits PM emissions from incinerators to a value determined by the following formula:

Emissions (lb/hr) = F x Incinerator Capacity (tons/hr)

Where, the factor, F, is as indicated in Table I below:

Table I: Factor, F, for Determining Maximum Allowable Particulate Emissions

<u>Incinerator Capacity</u>	<u>Factor F</u>
A. Less than 15,000 lbs/hr	5.43
B. 15,000 lbs/hr or greater	2.72

Based on information from the vendor, the HP section of the flare is currently designed to handle a worst-case scenario of 99,500 lbs-methanol/hour (49.75 tons/hour). Using this value in the above equation produces a PM emission limit of 135.32 lb/hr. WVM estimated that up to a worst-case of 14.70 lbs/hour of particulate matter emissions from the flare during a “Syn Loop Trip.” This is far below the 45CSR6 limit.

45CSR6 Opacity Limits for - Section 4.3, 4.4

Pursuant to Section 4.3, and subject to the exemptions under 4.4, the flare will have a 20% limit on opacity during operation. Proper design and operation of the flare should prevent any substantive opacity from the unit.

45CSR7: To Prevent and Control Particulate Air Pollution from Manufacturing Process Operations - (Partial Applicability)

45CSR7 has requirements to prevent and control particulate matter air pollution from manufacturing processes and associated operations. Pursuant to §45-7-2.20, a “manufacturing process” means “any action, operation or treatment, embracing chemical, industrial or manufacturing efforts . . . that may emit smoke, particulate matter or gaseous matter.” 45CSR7 has three substantive requirements *potentially* applicable to the particulate matter-emitting “source operations” at the proposed Pleasants County Methanol Plant. These are the opacity requirements under Section 3, the mass emission standards under Section 4, and the fugitive emission standards under Section 5.

Pursuant to §45-7-10, 45CSR7 does not apply to particulate matter emissions regulated under 45CSR2, excluding therefore the “fuel burning units” utilized as part of the SMRs. Additionally, the combustion exhaust from the flares are appropriately regulated under 45CSR6 (see above). This exclusion applies to the requirements under Section 3 and 4. Therefore, 45CSR7 will be applied only to the haulroads as required under Section 5.

45CSR7 Fugitive Emissions - Section 5

Pursuant to §45-7-5.1 and 5.2, each manufacturing process or storage structure generating fugitive particulate matter must include a system to minimize the emissions of fugitive particulate matter. All haul roads will be paved and maintained to minimize fugitive particulate matter emissions.

45CSR10: To Prevent and Control Air Pollution from the Emission of Sulfur Oxides

The purpose of 45CSR10 is to “prevent and control air pollution from the emission of sulfur oxides.” 45CSR10 has requirements limiting SO₂ emissions from “fuel burning units,” limiting in-stack SO₂ concentrations of “manufacturing process source operations,” and limiting H₂S concentrations in “process gas” streams that are combusted. Each substantive 45CSR10 requirement is discussed below.

45CSR10 Fuel Burning Units - Section 3

As noted under the discussion of 45CSR2 applicability, based on the same definitions therein, the proposed Duct Burners are each defined as a “fuel burning unit” and are subject to 45CSR10. The allowable sulfur dioxide (SO₂) emissions from applicable fuel burning units noted above, each identified as a Type “b” fuel burning unit in a Priority II Region (which includes Pleasants County), per 45CSR10, Section 3.1(e), is the product of 3.1 and the total design heat input of each applicable unit in million Btu per hour.

When combusting purge gas during steady-state operations, based on an aggregate MDHI of the three (3) 25.56 mmBtu/hr Duct Burners, the total facility-wide MDHI of applicable units is 76.68 mmBtu/hr. Using the above equation results in a SO₂ limit of 237.71 lbs/hr. As all the Duct Burners are required to be fueled by desulfurized purge gas during steady-state operations, the aggregate PTE of these fuel burning units would be only a trace amount of the 45CSR10 limit.

When combusting PNG during startup and unit trips, based on an aggregate MDHI of the three (3) 63.80 mmBtu/hr Duct Burners, the total facility-wide MDHI of applicable units is 191.40 mmBtu/hr. During these events, using the above equation results in a SO₂ limit of 593.34 pounds per hour. As all the SMR heaters/duct burners are fueled by PNG during these events, the aggregate PTE of these fuel burning units is only a trace amount of the 45CSR10 limit.

45CSR10 Process Gas Stream Combustion - Section 5

Section 5.1 of 45CSR10 prohibits the combustion of any “refinery process gas stream” that contains H₂S in excess of 50 grains for every 100 cubic feet of tail gas consumed. The purge gas stream that is combusted in the Duct Burners could be defined as a refinery process gas stream. However, according to information in the permit application, after the de-sulfurization process applied to the feedstock natural gas, there is no measurable amount of H₂S in the syngas stream (or the purge gas stream that is collected and used to fuel the Duct Burners). All sulfur must be removed down to at least undetectable levels (<100 ppb_v) or the catalysts in the methanol units will become contaminated.

45CSR10 Testing, Monitoring, Record-keeping, & Reporting (TMR&R) - Section 8

Section 8 of Rule 10 requires performance testing for initial compliance with the limits therein, monitoring for continued compliance, and record-keeping of that compliance. The TMR&R requirements are clarified under 45CSR10A and discussed below.

45CSR10A Applicability - Section 3

Pursuant to §45-10A-3.1(b), for heaters that combust “*natural gas, wood or distillate oil, alone or in combination,*” the units are not subject to the Testing and MRR Requirements under 45CSR10A. Similar to the discussion above under the 45CSR2, per the Director's discretion, as the Duct Burners only combust natural gas and purge gas cleaned of any substantive amount of sulfur compounds, no SO₂-specific testing, monitoring or record-keeping of these units will be required.

45CSR13: Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation

The proposed construction of the Pleasants County Methanol Plant has the potential to emit a regulated pollutant in excess of six (6) lbs/hour and ten (10) TPY (see Attachment A) and, therefore, pursuant to §45-13-2.24, the proposed facility is defined as a “stationary source” under 45CSR13. Pursuant to §45-13-5.1, “[n]o person shall cause, suffer, allow or permit the construction . . . and operation of any stationary source to be commenced without . . . obtaining a permit to construct.” Therefore, WVM is required to obtain a permit under 45CSR13 for the construction and operation of the proposed facility.

As required under §45-13-8.3 (“Notice Level A”), WVM placed a Class I legal advertisement in a “newspaper of *general circulation* in the area where the source is . . . located.” The ad ran on November 25, 2020 in the *St. Marys Oracle* and the affidavit of publication for this legal advertisement was submitted on November 30, 2020.

45CSR14: Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration - (Not Applicable)

45CSR14 establishes and adopts a preconstruction permit program for the construction and major modification of major stationary sources in areas of attainment with the National Ambient Air Quality Standards (NAAQS). Pleasants County is currently classified as in attainment with the NAAQS and, therefore, a proposed new “major stationary source” in Pleasants County would be subject to the provisions of 45CSR14. The proposed Pleasants County Methanol Plant is defined as a source listed under §45-14-2.43.a (“Chemical Process Plants”) and, therefore, pursuant to 2.43.b., would be defined as a “major stationary source” if any regulated pollutant has a PTE in excess of 100 TPY. The proposed facility, however, does not have a potential-to-emit of any regulated pollutant in excess of 100 TPY (see Table 5 above) and is, therefore, not defined as a major stationary source and is not subject to the provisions of 45CSR14.

45CSR27: To Prevent and Control the Emissions of Toxic Air Pollutants - (Not Applicable)

Pursuant to §45-27-3.1, the “owner or operator of a plant that discharges or may discharge a toxic air pollutant into the open air in excess of the amount shown in the Table A [of 45CSR27] shall employ [Best Available Technology] at all chemical processing units emitting the toxic air pollutant.” As shown in permit application, the PTE of formaldehyde emitted from the proposed Pleasants County Methanol Plant is greater than 0.5 TPY - greater than the 1,000 pound per year threshold given in Table A of 45CSR27. However, the natural gas-fired engines, that contribute all

but trace amounts of formaldehyde to the facility-wide PTE, do not meet the definition of “chemical processing units” under §45-27-2.4 and, therefore, the proposed facility is not subject to 45CSR27.

45CSR30: Requirements for Operating Permits

45CSR30 provides for the establishment of a comprehensive air quality permitting system consistent with the requirements of Title V of the Clean Air Act. The proposed Pleasants County Methanol Plant does not meet the definition of a “major source under §112 of the Clean Air Act” as outlined under §45-30-2.26 and clarified (fugitive policy) under 45CSR30b. The proposed facility-wide PTE (see Table 5 above) of any regulated pollutant does not exceed 100 TPY. Additionally, the facility-wide PTE does not exceed 10 TPY of any individual HAP or 25 TPY of aggregate HAPs.

However, as the facility is subject to various New Source Performance Standards (NSPS) - including 40 CFR 60, Subpart Dc - that do not contain a Title V permitting exemption, the proposed facility is subject to Title V as a non-major source. Non-major sources subject to Title V, pursuant to DAQ policy, are deferred from having to submit a Title V application but still pay annual fees pursuant to submission of a Certified Emissions Sheet (CES).

40 CFR 60, Subpart Db: Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units - (Not Applicable)

40 CFR 60 Subpart Db is the NSPS for industrial-commercial-institutional steam generating units for which construction, modification, or reconstruction is commenced after June 19, 1984 and that have a maximum design heat input capacity greater than 100 mmBtu/hr. The definition of “steam generating unit,” however, specifically exempts “process heaters.” The definition of process heaters means “*a device that is primarily used to heat a material to initiate or promote a chemical reaction in which the material participates as a reactant or catalyst.*” Based on this definition, Subpart Db will not apply to the HCR Heaters as their *primary* function of each unit is to provide heat for the reforming reaction in the SMR furnace. While the heated exhaust is also routed through heat exchangers to produce steam, the primary purpose of the units is clearly to promote a chemical reaction.

40 CFR Part 60, Subpart Dc: Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

Subpart Dc of 40 CFR 60 is the federal NSPS for small industrial-commercial-institutional “steam generating units” that have an MDHI of less than 100 mmBtu/hr and greater than 10 mmBtu/hr and that were constructed, modified, or reconstructed after June 9, 1989. Subpart Dc contains within it emission standards, compliance methods, monitoring requirements, and reporting and record-keeping procedures for affected facilities applicable to the rule. The definition of “steam generating unit,” however, specifically exempts “process heaters.” The definition of process heaters means “*a device that is primarily used to heat a material to initiate or promote a chemical reaction in which the material participates as a reactant or catalyst.*” The primary purpose of the SMR Duct Burners is to supply additional heat for the production of steam. The MDHI for the Duct Burner when combusting only purge gas is calculated to be 25.56 mmBtu/hr based on a purge gas flow of

55,318 scf/hr and a HHV of 462 Btu/scf. When combusting only PNG, the MDHI of the Duct Burner is calculated to be 63.80 mmBtu/hr based on a maximum PNG combustion rate of 58,850 scf/hr with an HHV of 1,084 Btu/scf. Therefore, based on the above, the units are subject to Subpart Dc.

Subpart Dc does not, however, have any emission standards for units that combust only natural gas (or, as in the case of the determination made by the DAQ, fuel gas derived from desulfurized PNG). Therefore, the proposed Duct Burners are only subject to the nominal record-keeping and reporting requirements given under §60.48c.

40 CFR 60, Subpart Kb: Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

Subpart Kb of 40 CFR 60 is the NSPS for storage tanks containing Volatile Organic Liquids (VOLs) which construction commenced after July 23, 1984. The Subpart applies to storage vessels used to store volatile organic liquids with a capacity greater than or equal to 75 m³ (19,813 gallons). However, storage tanks with a capacity greater than or equal to 151 m³ (39,890 gallons) storing a liquid with a maximum true vapor pressure less than 3.5 kilopascals (kPa) or with a capacity greater than or equal to 75 m³ but less than 151 m³ storing a liquid with a maximum true vapor pressure less than 15.0 kPa are exempt from Subpart Kb.

WVM is proposing eight (8) 375,000 gallon methanol product storage tanks for the facility. Methanol is defined as a VOL, has a vapor pressure in excess of 3.5 kPa (and less than 76.6 kPa), and all storage tanks are larger than 39,890 gallons. Therefore, all storage tanks are subject to the VOC standards as given under §60.112b.

Pursuant to §60.112b(a), Subpart Kb requires storage tanks with capacities in excess of 39,890 gallons and which store a VOL with a vapor pressure between 5.2 kPa and 76.6 kPa to comply with one of three control options:

- (1) A fixed roof in combination with an internal floating roof;
- (2) An external floating roof; or
- (3) A closed vent system and control device designed and operated to reduce inlet VOC emissions by 95 percent or greater.

WVM has proposed to meet requirement §60.112b(a)(3) by utilizing a vapor balance system for all methanol storage tanks. The storage tanks are designed to operate under pressure using a nitrogen blanket to prevent any working/breathing losses. Any over pressure occurrences will vent back to the process are routed to the fuel header and then to the SMR burners (the combustion of which would control VOCs to greater than 95%).

40 CFR 60, Subpart VVa: Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry for Which Construction, Reconstruction, or Modification Commenced After November 7, 2006

Subpart VVa applies to "*affected facilities in the synthetic organic chemicals manufacturing industry.*" "Synthetic organic chemicals manufacturing industry is defined in Subpart VVa as an "*industry that produces, as intermediates or final products, one or more of the chemicals listed in §60.489.*" §60.489 lists methanol as an applicable product.

Subpart VVa contains LDAR requirements for all affected facilities at the proposed facility; these affected facilities are defined under Subpart VVa as "*the components assembled and connected by pipes or ducts to process raw materials and . . . includes any feed, intermediate and final product storage vessels (except as specified in §60.482–1a(g)), product transfer racks, and connected ducts and piping.*" Most substantively, Subpart VVa defines a leak (and triggers repair procedures) when pollutant concentrations are detected in excess of 500 ppm_v for valves in gas and light liquid service and connectors in gas service. WVM will be required to meet the various applicable standards under VVa.

40 CFR, 60, Subpart NNN: Standards of Performance for Volatile Organic Compound (VOC) Emissions From the Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations

Pursuant to §60.660, 40 CFR 60, Subpart NNN applies to "*each affected facility designated in paragraph (b) of this section that is part of a process unit that produces any of the chemicals listed in §60.667 as a product, co-product, by-product, or intermediate, except as provided in paragraph (c).*" The chemicals listed in §60.667 include methanol and, therefore, Subpart NNN applies to the proposed WVM facility (which includes a distillation unit). The substantive requirements of Subpart NNN are given under §60.662 and apply to "*each vent stream on and after the date on which the initial performance test required by §60.8 and §60.664 is completed.*" Vent stream is defined as "*any gas stream discharged directly from a distillation facility to the atmosphere or indirectly to the atmosphere after diversion through other process equipment. The vent stream excludes relief valve discharges and equipment leaks including, but not limited to, pumps, compressors, and valves.*" The requirements under §60.662 are to:

- (a) Reduce emissions of TOC (less methane and ethane) by 98 weight-percent, or to a TOC (less methane and ethane) concentration of 20 ppm_v, on a dry basis corrected to 3 percent oxygen, whichever is less stringent. If a boiler or process heater is used to comply with this paragraph, then the vent stream shall be introduced into the flame zone of the boiler or process heater;
- (b) Combust the emissions in a flare that meets the requirements of §60.18; or
- (c) Maintain a TRE index value greater than 1.0 without use of VOC emission control devices.

The vented syngas streams are considered a “vent stream” under Subpart NNN and subject to one of the requirements under §60.662(a) through (c). WVM has proposed compliance with the above requirements by combusting purge gas in the SMR Heaters (during steady-state operations) and in the flares (during start-up/shutdown/unit trip operations). All other vent streams are recycled back into the reformer feed lines for processing.

40 CFR 60, Subpart RRR: Standards of Performance for Volatile Organic Compound Emissions From Synthetic Organic Chemical Manufacturing Industry (SOCMI) Reactor Processes

Pursuant to §60.700, 40 CFR 60, Subpart RRR applies to “*each affected facility designated in paragraph (b) of this section that is part of a process unit that produces any of the chemicals listed in §60.707 as a product, co-product, by-product, or intermediate, except as provided in paragraph (c).*” The chemicals listed in §60.707 include methanol and, therefore, Subpart RRR applies to the proposed WVM facility. The substantive requirements of Subpart RRR are given under §60.702 and apply to “*each vent stream on and after the date on which the initial performance test required by §60.8 and §60.704 is completed.*” Vent stream is defined as “*any gas stream discharged directly from a distillation facility to the atmosphere or indirectly to the atmosphere after diversion through other process equipment. The vent stream excludes relief valve discharges and equipment leaks including, but not limited to, pumps, compressors, and valves.*” The requirements under §60.702 are to:

- (a) Reduce emissions of TOC (less methane and ethane) by 98 weight-percent, or to a TOC (less methane and ethane) concentration of 20 ppmv, on a dry basis corrected to 3 percent oxygen, whichever is less stringent. If a boiler or process heater is used to comply with this paragraph, then the vent stream shall be introduced into the flame zone of the boiler or process heater;
- (b) Combust the emissions in a flare that meets the requirements of §60.18; or
- (c) Maintain a TRE index value greater than 1.0 without use of VOC emission control devices.

The vented syngas streams are considered a “vent stream” under Subpart RRR and subject to one of the requirements under §60.702(a) through (c). WVM has proposed compliance with the above requirements by combusting purge gas in the SMR Heaters (during steady-state operations) and in the flares (during start-up/shutdown/unit trip operations). All other vent streams are recycled back into the reformer feed lines for processing.

40 CFR 60, Subpart JJJJ: Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

WVM’s proposed seven (7) 4SLB, 5,500 hp, Caterpillar Model CG260-16 natural gas-fired engines are defined under 40 CFR 60, Subpart JJJJ as a stationary spark-ignition internal combustion engines (SI ICE) and are, pursuant to §60.4230(a)(4)(i), subject to the applicable provisions of the rule.

Pursuant to §60.4233(e): “*Owners and operators of stationary SI ICE with a maximum engine power greater than or equal to 75 KW (100 HP) (except gasoline and rich burn engines that use LPG) must comply with the emission standards in Table 1 to this subpart for their stationary SI ICE.*” Therefore, as a new engine that is greater than 100 hp, it must comply with the emission standards under Table 1 for “Non-Emergency SI Natural Gas HP≥500 hp manufactured after July 1, 2010.” NO_x - 1.0 g/HP-hr, CO - 2.0 g/HP-hr, and VOC - 0.7 g/HP-hr. The emission standards and the proposed compliance therewith of the engines are given in the following table:

Table 6: Subpart JJJJ Compliance

Pollutant	Standard (g/HP-hr)	Uncontrolled Emissions (g/hp-hr) ⁽¹⁾	Control Percentage	Controlled Emissions (g/hp-hr) ⁽¹⁾	JJJJ Compliant?
NO _x	1.0	0.94	86.00%	0.13	Yes
CO	2.0	1.28	91.90%	0.10	Yes
VOC	0.7	0.16	50.00%	0.08	Yes

(1) Uncontrolled emissions are based on the vendor data supplied in the permit application (pp. 120). Controlled emissions are based on the conservative SCR/OxCat control percentages as noted under Table 4.

Compliance with the requirements above may be determined by either purchasing an engine certified to meet the above standards and demonstrating continuous compliance according to the procedures of §60.4243(a) or purchasing a non-certified engine and demonstrating compliance according to the requirements specified in §60.4244, as applicable, and according to paragraphs §60.4243(b)(2)(i) and (ii).

40 CFR 63 Subpart ZZZZ: Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

On June 1, 2013 the DAQ took delegation of the area source provisions of 40 CFR 63, Subpart ZZZZ. As the proposed Pleasants County Methanol Plant is defined as an area source of HAPs (see Attachment A), the facility is subject to applicable requirements of Subpart ZZZZ. Pursuant to §63.6590(c):

An affected source that meets any of the criteria in paragraphs (c)(1) through (7) of this section must meet the requirements of this part by meeting the requirements of 40 CFR part 60 subpart IIII, for compression ignition engines or 40 CFR part 60 subpart JJJJ, for spark ignition engines. No further requirements apply for such engines under this part.

§63.6590(c)(1) specifies that “[a] new or reconstructed stationary RICE located at an area source” is defined as a RICE that shows compliance with the requirements of Subpart ZZZZ by “*meeting the requirements of 40 CFR part 60 subpart IIII, for compression ignition engines or 40 CFR part 60 subpart JJJJ, for spark ignition engines.*” Pursuant to §63.6590(a)(2)(iii), a “*stationary RICE located at an area source of HAP emissions is new if [the applicant] commenced construction of the stationary RICE on or after June 12, 2006.*” The seven (7) Caterpillar Model CG260-16 natural gas-fired engines proposed for the Pleasants County Methanol Plant would each be defined as a new stationary RICE (manufacture dates are after 2006) and, therefore, would show compliance with Subpart ZZZZ by meeting the requirements of 40 CFR 60, Subpart JJJJ. Compliance with that rule is discussed above.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

This section provides information on those regulated pollutants that may be emitted from the proposed Pleasants County Methanol Plant and that are not classified as “criteria pollutants.” Criteria pollutants are defined as Carbon Monoxide (CO), Lead (Pb), Oxides of Nitrogen (NO_x), Ozone, Particulate Matter (PM₁₀ and PM_{2.5}), and Sulfur Dioxide (SO₂). These pollutants have National Ambient Air Quality Standards (NAAQS) set for each that are designed to protect the public health and welfare. Other pollutants of concern, although designated as non-criteria *and without national concentration standards*, are regulated through various state and federal programs designed to limit their emissions and public exposure. These programs include federal source-specific HAP regulations promulgated under 40 CFR 61 and 40 CFR 63 (NESHAPS/MACT), and WV Legislative Rule 45CSR27 that regulates certain HAPs defined as Toxic Air Pollutants (TAPs). Any potential applicability to these programs were discussed above under REGULATORY APPLICABILITY.

The majority of non-criteria regulated pollutants fall under the definition of HAPs which are compounds identified under Section 112(b) of the Clean Air Act (CAA) as pollutants or groups of pollutants that EPA knows or suspects *may* cause cancer or other serious human health effects. These adverse health affects, however, may be associated with a wide range of ambient concentrations and exposure times and are influenced by source-specific characteristics such as emission rates and local meteorological conditions. Health impacts are also dependent on multiple factors that affect variability in humans such as genetics, age, health status (e.g., the presence of pre-existing disease) and lifestyle. As stated previously, *there are no applicable federal or state ambient air quality standards for these specific chemicals*. For a complete discussion of the potential health effects of each compound listed in this section, refer to the IRIS database located at www.epa.gov/iris. It is important to note that the USEPA does not divide the various HAPs into further classifications based on toxicity or if the compound is a suspected carcinogen.

The majority of HAPs from the proposed Pleasants County Methanol Plant are emitted from the on-site natural gas-fired power generation site. The aggregated HAP PTE’s calculated from the power generation site are assumed to be conservative as WVM will not operate more than six (6) engines at any one time but calculated the aggregate PTE based on all seven (7) engines operating simultaneously at 8,760 hours/yr. Additionally, the oxidation catalysts on the engines will mitigate some of the HAP emissions. WVM, however, again to be conservative, took lower DREs for the HAPs then provided by the vendor (generally 5-10% lower). The speciated HAP emission rates from the power generation unit are given on page 159 of the permit application. Substantive amounts of additional HAPs are *potentially* emitted from equipment leaks. Small amounts of HAPs are estimated from other sources as shown in Attachment A. It is important to note that the HAP emissions from the engines and equipment leaks would occur over the course of the entire year and, in the case of the engines, would be dispersed up and out of a stack to reduce any substantive pollutant concentrations. It is also important to note that, other than formaldehyde, no HAP is emitted in aggregate from all the engines at a rate over 1.0 lb/hr.

Table 7 lists each HAP currently identified in the permit application as potentially emitted in an amount greater than 100 lbs/year from the proposed facility. Additionally, information concerning the pollutant, and the associated carcinogenic risk (as based on analysis provided in the

Integrated Risk Information System (IRIS)), and any potentially applicable MACT is provided in Attachment B.

Table 7: Non-Criteria Pollutants

Pollutant	CAS #	PTE (tons/yr)
Acetaldehyde	75-07-0	2.82
Acrolein	107-02-8	1.40
Benzene	71-43-2	0.17
Biphenyl	92-52-4	0.23
1,3-Butadiene	106-99-0	0.09
Formaldehyde	50-00-0	8.17
n-Hexane	110-54-3	1.36
Methanol	67-56-1	8.09
Naphthalene	91-20-3	0.08
Toluene	108-88-3	0.20
2,2,4-Trimethylpentane	540-84-1	0.27
Xylene	1330-20-7	0.09

AIR QUALITY IMPACT ANALYSIS

The estimated maximum emissions of the proposed facility are less than applicability thresholds that would define the revised facility as “major” under 45CSR14 and, therefore, no air quality impacts modeling analysis was performed.

MONITORING, COMPLIANCE DEMONSTRATIONS, REPORTING, AND RECORDING OF OPERATIONS

Refer to Section 4.2 of the draft permit for all unit-specific monitoring, compliance demonstration, reporting, and record-keeping requirements (MRR). In addition to statutory MRR specifically required by state and federal rules, applicable site-specific MRR includes:

- The permittee is required to provide verification of all limited MDHI and maximum design capacities upon which the calculations were based (4.2.1, 4.2.2);
- Facility-wide methanol production and hours of operation monitoring is required to demonstrate compliance with the maximum design production capability of the facility (4.2.3.);

- A CEMS is required for the continuous and real time compliance demonstration of NO_x and CO emissions from the combination HTCR Heater/Duct Burner exhaust from each methanol unit (4.2.4);
- A predictive emissions monitoring system (PEMS) to determine and aggregate actual emissions from all startup/shutdown/unit trip events is required to show compliance with the operational scenario emission limits (4.2.5);
- Methanol unit flare performance MRR is required (4.2.7); and
- Visible emissions MRR is required for the flares and other applicable emissions units (4.2.8);

PERFORMANCE TESTING OF OPERATIONS

Refer to Section 4.3 of the draft permit all unit-specific performance testing requirements. In addition to statutory performance testing specifically required by state and federal rules, applicable site-specific performance testing includes:

- An initial performance test (4.3.2) is required to show compliance with the NO_x, CO, and VOC emissions from the combination HTCR Heater/Duct Burner exhaust from each methanol unit (thereafter continuous compliance with the NO_x and CO emissions are determined by the CEMs);
- An initial performance test (4.3.3) is required to determine the sulfur content and the HAP(s) content of the fuel gas; and
- An initial performance test (4.3.4) is required, commensurate with the timing requirements of Subpart JJJJ, to show compliance with the NO_x, CO, and VOC emissions from the combination from each RICE.

RECOMMENDATION TO DIRECTOR

The information provided in permit application R13-3509 indicates that compliance with all applicable state and federal air quality regulations will be achieved. Therefore, I recommend to the Director that the DAQ go to public notice with a preliminary determination to issue Permit Number R13-3509 to West Virginia Methanol, Inc. for the construction of the Pleasants County Methanol Plant located in Waverly, Pleasants County, WV.

Joe Kessler, PE
Engineer

Fact Sheet R13-3509
West Virginia Methanol, Inc.
Pleasants County Methanol Plant

Attachment A: Facility-Wide PTE
West Virginia Methanol, Inc.: Pleasants County Methanol Plant
Permit Number R13-3509: Facility ID 073-00040

Emission Unit	EP ID	CO		NO _x		PM _{2.5} ⁽¹⁾		PM ₁₀ ⁽¹⁾		PM ⁽¹⁾		SO _x		VOC		Total HAPs ⁽²⁾	
		lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
SMR Steady-State	E1A E2A E3A	5.53	24.24	9.09	39.81	3.02	13.22	3.02	13.22	3.02	13.22	0.42	1.83	3.02	13.22	0.35	1.514
SMR Startup/Shutdown/ Unit Trip	E1A E2A E3A	8.13	0.45	5.73	0.45	3.06	0.17	4.11	0.22	4.11	0.22	0.51	0.004	8.64	0.49	0.99	0.055
HP Flare ⁽³⁾	E2A E2B E2C	523.01	27.35	38.82	3.57	11.02	0.71	14.70	0.94	14.70	0.94	0.25	0.002	9.99	0.48	10.02	0.317
LP Flare and Pilot Lights	E2A E2B E2C	0.25	1.08	0.06	0.26	0.002	0.009	0.002	0.009	0.002	0.009	0.001	0.002	0.005	0.021	0.002	0.007
Engines	E3G1 - E3G7	8.81	38.60	11.16	48.90	0.80	3.50	0.80	3.50	0.80	3.50	0.14	0.61	6.71	29.40	3.59	15.72
Component Leaks ⁽³⁾	Fugitive, 5E	0.01	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34	5.87	1.34	5.850
Vehicle Activity	Fugitive	0.00	0.00	0.00	0.00	0.01	0.06	0.05	0.24	0.27	1.20	0.00	0.00	0.00	0.00	0.00	0.000
Facility-Wide Total⁽⁴⁾ →		14.60	91.78	20.31	92.99	3.83	17.67	3.87	18.13	4.09	19.09	0.56	2.45	11.07	49.48	5.28	23.46

- (1) Includes condensables.
- (2) As the PTE of all individual HAPs are less than 10 TPY (the single HAP with the highest emission rate is Formaldehyde at 8.17 TPY) and the PTE of total HAPs is less than 25 TPY, the proposed Pleasants County Methanol Plant is defined as a minor (area) source of HAPs for purposes of 40 CFR 61 and 40CFR63.
- (3) The emissions in this row are the combination of emissions from unburnt purge gases and the products of combustion. Emissions from unburnt vapors sent to the LP section of the flare from the PSVs are quantified as part of the "Component Leaks." Hourly emissions are inflated based on worst-case short term emissions during startup/shutdown or unit trips.
- (4) Totals may be slightly different than those given in Attachment N due to rounding. Attachment N totals are considered definitive. Hourly emissions in this row are steady-state values and do not reflect the short term flaring values that occur during startup/shutdown/unit trips.

Attachment B: Non-Criteria Regulated Pollutant Information

West Virginia Methanol, Inc.: Pleasants County Methanol Plant

Permit Number R13-3509: Facility ID 073-00040

Pollutant	CAS #	PTE (tons/yr)	Source	Known/Suspected Carcinogen	Classification	MACT ⁽¹⁾
Acetaldehyde	75-07-0	2.82	RICE	Yes	B2 - Probable Human Carcinogen ⁽²⁾	ZZZZ
Acrolein	107-02-8	1.40	RICE	No	Inadequate Data ⁽³⁾	ZZZZ
Benzene	71-43-2	0.17	RICE SMR	Yes	A - Known Human Carcinogen ⁽⁴⁾	ZZZZ
Biphenyl	92-52-4	0.23	RICE	Yes	Suggestive Evidence ⁽⁵⁾	ZZZZ
1,3-Butadiene	106-99-0	0.09	RICE	Yes	Known Carcinogen ⁽⁶⁾	ZZZZ
Formaldehyde	50-00-0	8.17	RICE SMR	Yes	B1 - Probable Human Carcinogen ⁽⁷⁾	ZZZZ
n-Hexane	110-54-3	1.36	SMR	No	Inadequate Data ⁽⁸⁾	ZZZZ
Methanol	67-56-1	8.09	RICE SMR Fugitive	No	Not Assessed ⁽⁹⁾	ZZZZ
Naphthalene	91-20-3	0.08	RICE SMR	Yes	C - Possible Human Carcinogen ⁽¹⁰⁾	ZZZZ
Toluene	108-88-3	0.20	RICE SMR	No	Inadequate Data ⁽¹¹⁾	ZZZZ
2,2,4-Trimethylpentane	540-84-1	0.27	RICE	No	Inadequate Data ⁽¹²⁾	ZZZZ
Xylene	1330-20-7	0.09	RICE	No	Inadequate Data ⁽¹³⁾	ZZZZ

(1) Does a MACT apply to this specific HAP for any emission unit at the facility? See “Regulatory Applicability” section for discussion.

(2) [**Acetaldehyde**] From IRIS: “Based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.”

(3) [**Acrolein**] From IRIS: “Under the Draft Revised Guidelines for Carcinogen Risk Assessment (U.S. EPA, 1999), the potential carcinogenicity of acrolein cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure. There are no adequate human studies of the carcinogenic potential of acrolein. Collectively, experimental studies provide inadequate evidence that acrolein causes cancer in laboratory animals.”

- (4) **[Benzene]** From IRIS: “Benzene is classified as a “known” human carcinogen (Category A) under the Risk Assessment Guidelines of 1986. Under the proposed revised Carcinogen Risk Assessment Guidelines (U.S. EPA, 1996), benzene is characterized as a known human carcinogen for all routes of exposure based upon convincing human evidence as well as supporting evidence from animal studies. (U.S. EPA, 1979, 1985, 1998; ATSDR, 1997).”
- (5) **[Biphenyl]** From IRIS: “Under EPA’s Guidelines for Carcinogen Risk Assessment (U.S. EPA, 2005a), the database for biphenyl provides “suggestive evidence of carcinogenic potential” based on increased incidence of urinary bladder tumors (transitional cell papillomas and carcinomas) in male F344 rats (Umeda et al., 2002) and liver tumors (hepatocellular adenomas and carcinomas) in female B6F1 mice (Umeda et al., 2005) exposed to biphenyl in the diet for 104 weeks, as well as information on mode of carcinogenic action. The carcinogenic potential of biphenyl in humans has not been investigated.”
- (6) **[1,3-Butadiene]** From IRIS: “Under EPA’s 1999 Guidelines for Carcinogen Risk Assessment (U.S. EPA, 1999), 1,3-butadiene is characterized as carcinogenic to humans by inhalation. This characterization is supported by the total weight of evidence provided by the following: (1) sufficient evidence from epidemiologic studies of the majority of U.S. workers occupationally exposed to 1,3-butadiene, either to the monomer or to the polymer by inhalation, showing increased lymphohematopoietic cancers and a dose-response relationship for leukemias in polymer workers (see Section II.A.2), (2) sufficient evidence in laboratory animal studies showing that 1,3-butadiene causes tumors at multiple sites in mice and rats by inhalation (see Section II.A.3), and (3) numerous studies consistently demonstrating that 1,3-butadiene is metabolized into genotoxic metabolites by experimental animals and humans (see Section II.A.4). The specific mechanisms of 1,3-butadiene-induced carcinogenesis are unknown however, the scientific evidence strongly suggests that the carcinogenic effects are mediated by genotoxic metabolites of 1,3-butadiene, i.e., the monoepoxide, the diepoxide, and the epoxydiol.”
- (7) **[Formaldehyde]** From IRIS: “Based on limited evidence in humans, and sufficient evidence in animals. Human data include nine studies that show statistically significant associations between site-specific respiratory neoplasms and exposure to formaldehyde or formaldehyde-containing products. An increased incidence of nasal squamous cell carcinomas was observed in long-term inhalation studies in rats and in mice. The classification is supported by in vitro genotoxicity data and formaldehyde’s structural relationships to other carcinogenic aldehydes such as acetaldehyde.”
- (8) **[n-Hexane]** From IRIS: “Under the Guidelines for Carcinogen Risk Assessment, there is inadequate information to assess the carcinogenic potential of n-hexane.”
- (9) **[Methanol]** From IRIS: “Not assessed under the IRIS Program.”
- (10) **[Naphthalene]** From IRIS: “Using criteria of the 1986 Guidelines for Carcinogen Risk Assessment, naphthalene is classified in Group C, a possible human carcinogen. This is based on the inadequate data of carcinogenicity in humans exposed to naphthalene via the oral and inhalation routes, and the limited evidence of carcinogenicity in animals via the inhalation route. Using the 1996 Proposed Guidelines for Carcinogen Risk Assessment, the human carcinogenic potential of naphthalene via the oral or inhalation routes “cannot be determined” at this time based on human and animal data; however, there is suggestive evidence (observations of benign respiratory tumors and one carcinoma in female mice only exposed to naphthalene by inhalation [NTP, 1992a]). Additional support includes increase in respiratory tumors associated with exposure to 1-methylnaphthalene.”
- (11) **[Toluene]** From IRIS: “Under the Guidelines for Carcinogen Risk Assessment (U.S. EPA, 2005), there is inadequate information to assess the carcinogenic potential of toluene because studies of humans chronically exposed to toluene are inconclusive, toluene was not carcinogenic in adequate inhalation cancer bioassays of rats and mice exposed for life (CIIT, 1980 NTP, 1990 Huff, 2003), and increased incidences of mammary cancer and leukemia were reported in a lifetime rat oral bioassay at a dose level of 500 mg/kg-day but not at 800 mg/kg-day (Maltoni et al., 1997).”
- (12) **[2,2,4-Trimethylpentane]** From IRIS: “In accordance with the Guidelines for Carcinogen Risk Assessment (U.S. EPA, 2005a), there is inadequate information to assess carcinogenic potential for 2,2,4-trimethylpentane.”
- (13) **[Xylenes]** From IRIS: “Under the Draft Revised Guidelines for Carcinogen Risk Assessment (U.S. EPA, 1999), data are inadequate for an assessment of the carcinogenic potential of xylenes. Adequate human data on the carcinogenicity of xylenes are not available, and the available animal data are inconclusive as to the ability of xylenes to cause a carcinogenic response. Evaluations of the genotoxic effects of xylenes have consistently given negative results.”